Hydrologic Modeling Inventory
Model Response Form

Name of Model:

GR1A

(stands for : modèle du Génie Rural à 1 paramètre Annuel (i.e. Rural Engineering Annual 1-parameter model))

Model Type:

GR1A is an annual lumped continuous rainfall-runoff model.

Model Objective(s):

The GR1A model was designed for streamflow simulation. It can be applied used for various applications related to water resources assessment and water management (series extension, trend detection…).

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Model Structure or Mathematical Basis:

The GR1A model (see Mouelhi et al., 2006 for a full model description of the latest model version) is an annual conceptual rainfall-runoff model developed for applications at the basin scale (lumped mode).

The model has been developed by Mouelhi (2003).

The model is a simple equation which gives streamflow for year *n* as a function of rainfalls for years *n* and *n*-1 and potential evapotranspiration for year *n*.

Model Parameters:

The model has only one free parameter. The parameter has no direct physical interpretation and must be calibrated using observed rainfall-flow series.

Spatial Scale Employed in the Model:

The model is to be run in a lumped mode.

Temporal Scale Employed in the Model:

The model is to be run at an annual time step.

Input Data Requirements:

The model requires as only input:

- annual time-series of observed catchment areal rainfall;
- annual time-series of potential evapotranspiration estimates (a mean interannual value may be sufficient).

Annual observed streamflow time-series will be necessary to calibrate model parameters.

Computer Requirements:

Given its very simple structure, GR1A can even be run in a spreadsheet, there is no specific requirement.

Model Output:

The model simulates annual streamflow time-series.

Parameter Estimation / Model Calibration:

Simple local search optimization algorithms are sufficient to locate a satisfactory model parameter optimum. A "step-by-step" method developed at Cemagref provides satisfactory results. Given that a single parameter must be optimized, a manual calibration is easy.

Model Testing and Verification:

Model code was extensively tested and verified all along the successive steps of model development.

Model Sensitivity:

Model parameter sensitivity was analyzed by Mouelhi (2003).

Model Reliability:

The model is considered as particularly robust thanks to its parsimony.

Model Application / Case Studies:

All along its development, the model was extensively tested on several hundreds of catchments (e.g. more than 400 basins in the study by Mouelhi, 2003):

- in France (Mouelhi, 2003);
- in the United States (Mouelhi, 2003);
- in the Australia (Mouelhi, 2003);
- in the Ivory Coast (Mouelhi, 2003);
- in Brazil (Mouelhi, 2003);

Documentation:

Mouelhi, S. (2003), Vers une chaîne cohérente de modèles pluie-débit conceptuels globaux aux pas de temps pluriannuel, annuel, mensuel et journalier, PhD thesis, 323 pp, ENGREF, Cemagref Antony, France.

Mouelhi, S., C. Michel , C. Perrin, and V. Andreassian (in press), Linking stream flow to rainfall at the annual time step: the Manabe bucket model revisited, J. Hydrol., doi:10.1016/j.jhydrol.2005.1012.1022.